

PROJECT facts

Environmental & Water
Resources

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U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY



HEALTH EFFECTS OF SUB-CHRONIC INHALATION OF SIMULATED DOWNWIND COAL COMBUSTION EMISSIONS

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Description

Objective

The objective of this project is to conduct a laboratory study providing a comprehensive contemporary evaluation of selected respiratory and cardiac health hazards from repeated inhalation exposure to “simulated downwind” coal combustion emissions.

Background

Although emissions from coal-fired power plants and their atmospheric reaction products contribute to environmental air pollution and are often cited as among the important sources of pollution-related health risks, there have been few toxicological evaluations of the health hazards of breathing coal emissions or of the influences of coal type, operating variables, emission reduction strategies, and atmospheric reactions. Virtually no toxicological research has been done to place “downwind” (rather than “top of the stack”) emissions into context regarding pollution health risks.

Summary

This project will provide, for the first time, an integrated toxicological evaluation of the existence and dose-response relationships of cardio-respiratory effects of repeatedly inhaling a mixture of particulate matter and gases simulating the principal “downwind” components of air pollution from coal-fired power plants. The resulting coal emission exposure data will be compared with diesel and gasoline emissions, hardwood smoke, and street dust exposure data already generated by Lovelace Respiratory Research Institute (LRRI) using the identical experimental protocol. This data will be beneficial in determining which components of particulate matter should be regulated and why.

Specifically, the project will encompass the following: 1) establishing a laboratory-generated exposure atmosphere containing key particulate and gaseous species in ratios considered appropriate by atmospheric and combustion scientists; 2) conducting sub-chronic (daily up to six months) repeated inhalation exposures of rodents to four graded dilutions of the atmosphere, producing dose-response data down to environmentally-relevant concentrations; 3) measuring a spectrum of health outcomes and mechanisms in the respiratory and cardiovascular systems that span multiple key public health concerns; 4) evaluating and publishing results demonstrating the presence or absence of health hazards and the nature of the



COST

Total Project Value

\$3,269,342

DOE/Non-DOE Share

\$960,036 / \$2,309,306

PERIOD OF PERFORMANCE

February 2005 to
January 2008

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dose-response curve, including evidence of thresholds; and 5) comparing the biological effects of coal combustion emissions to effects of other source emissions measured using the identical experimental protocol.

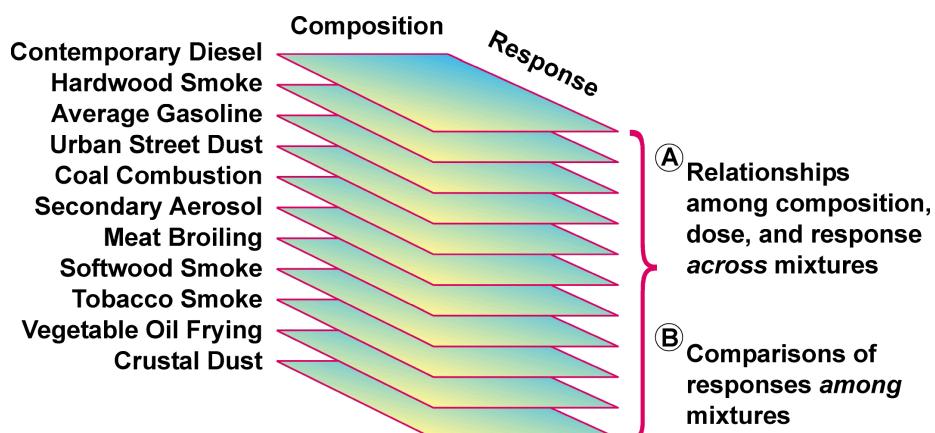
Accomplishments

At this early stage of the project, the procurement and set-up of the drop-tube furnace components have been completed.

Planned Activities

Phase I of the project will develop the exposure atmosphere, including setting up a drop-tube furnace, developing the emissions modification system, establishing operating conditions necessary to achieve an exposure atmosphere meeting consensus criteria developed in an expert workshop, and comparing results from Powder River Basin (PRB) sub-bituminous and Low Sulfur Southern Appalachian (LSSA) bituminous coals.

Phase II will involve conducting the toxicological study using one coal type, including exposures to four dilutions of the atmosphere for times ranging from a few days to six months (depending on the health endpoint), conducting health assays according to the protocol used successfully in studies of diesel emissions, hardwood smoke, gasoline emissions, and street dust by the National Environmental Respiratory Center (NERC, www.nercenter.org) program at LRRI, analyzing exposure concentration-response relationships, comparing the results to those from studies of the other source emissions, and publishing the results and analyses.



NERC's Composition-Concentration-Response Data Matrix.